CLAIMS

1. A method for the quantitative assessment of the overall and specific DNA repair capacities of at least one biological medium, which method is characterized in that it comprises the following steps:

(a) preparing a range of plasmids, each comprising distinct DNA lesions, by independent treatment of said various plasmids with at least one physical and/or chemical agent and recovery of the supercoiled fraction of each of said plasmids,

(b) characterizing the lesions present on each of the plasmids of said range of plasmids,

(c) depositing the various plasmids of said range of plasmids, and at least one supercoiled control plasmid without lesions, onto a single solid support, according to a pre-established configuration A, so as to form a functionalized support divided into different zones A_1 to A_x, x corresponding to an integer equal to the number of biological media to be simultaneously tested, each zone A_1 to A_x comprising said range of plasmids,

(d) incubating said functionalized support obtained in step (c) with various repair solutions, each comprising at least one biological medium that may contain enzyme activities for repair, ATP, an ATP-regenerating system, a labeled nucleotide triphosphate and any other component necessary for the activity of the repair enzymes present in said biological medium, preferably at a temperature of 30°C for 1 to 5 hours, preferably for 3 hours, each of said repair solutions being deposited, prior to said incubation, in each of

said different and pre-established zones A_1 to A_x of said functionalized support,

(e) washing said functionalized support at least once,

(f) directly or indirectly measuring the signal produced by the label incorporated into the DNA during the repair reaction in step (d), in each of said different and pre-established zones A_1 to A_x,

(g) recording and quantifying the signal corresponding to each deposit of plasmid in each zone A_1 to A_x, and

(h) determining the ratio of the signals of the plasmids comprising the lesions relative to the control plasmid jointly deposited.

2. The method as claimed in claim 1, characterized in that the plasmids according to step (a) are chosen from those that have a double-stranded supercoiled form.

3. The method as claimed in claim 1 or claim 2, characterized in that, in step (a) of said method, the various physical or chemical agents capable of inducing a lesion of the DNA are chosen from those that preferably induce: the formation of a single lesion, the formation of a limited number of lesions or the formation of various lesions belonging to the same family.

4. The method as claimed in any one of claims 1 to 3, characterized in that, in step (a) of said method, various agents are used on each plasmid of said range of plasmids.

5. The method as claimed in any one of claims 1 to 4, characterized in that, in step (b) of said method, the characterization of the lesions comprises (i) taking a fraction of each plasmid with lesions, (ii) digesting each of said fractions with enzymes that release the nucleosides from the DNA, and then (iii) analyzing the result of the digestion using a combination of separative techniques coupled to a quantitative analytical technique.

6. The method as claimed in claim 5, characterized in that the digestion is carried out using at least one of the following enzymes: calf spleen phosphodiesterase, P1 nuclease, snake venom phosphodiesterase, and alkaline phosphatase.

7. The method as claimed in claim 5 or claim 6, characterized in that the result of the enzyme digestion is analyzed by means of one of the following techniques: high performance liquid chromatography (HPLC) coupled to tandem mass spectrometry, by HPLC coupled to gas chromatography or by HPLC coupled to electrochemical detection.

8. The method as claimed in any one of claims 1 to 7, characterized in that, prior to step (c), the supercoiled forms of the plasmids obtained in step (a) are purified by sucrose gradient centrifugation and/or cesium chloride gradient centrifugation.

9. The method as claimed in any one of claims 1 to 8, characterized in that, also prior to step (c), each of the plasmids of the range of plasmids is diluted to a concentration of between 5 and 100 µg/ml, in a diluting buffer preferably comprising a buffer at a pH of between 6.5 and

8.0, optionally combined with a salt and with a nonionic surfactant.

10. The method as claimed in any one of claims 1 to 9, characterized in that, in step (c) of said method, the volumes of the deposits of the range of plasmids are preferably between 100 and 1000 picoliters.

11. The method as claimed in any one of claims 1 to 10, characterized in that, in step (c) of said method, said support is a support that has been sensitized so as to increase its affinity for the DNA, selected from the group consisting of organic or inorganic materials chosen from glass, silicon and its derivatives, and synthetic or nonsynthetic polymers, and the surface of which is optionally functionalized.

12. The method as claimed in claim 11, characterized in that said support consists of glass slides coated with poly-L-lysine that adsorb the DNA, or glass slides functionalized with epoxy groups that form covalent bonds with the DNA.

13. The method as claimed in claim 11 or claim 12, characterized in that said support comprises different zones A_1 to A_x, each of said zones comprising:

- at least one deposit of control plasmid, and
- a deposit of plasmid containing photoproducts, and/or
- a deposit of plasmid containing oxidative damage, and/or
- a deposit of plasmid containing etheno-bases, and/or
- a deposit of plasmid containing DNA breakages, and/or

- a deposit of plasmid containing carcinogenic agent adducts.

14. The method as claimed in any one of claims 1 to 13, characterized in that, in step (e) of the method as claimed in claim 1, the support is washed at least once with a saline solution containing a nonionic surfactant, in particular a 10 mM phosphate buffer containing Tween 20, and is then subsequently rinsed with water at least once.

15. The method as claimed in any one of claims 1 to 14, characterized in that, in step (f) of the method as claimed in claim 1, the signal is measured by means of a method suitable for the label.

16. The method as claimed in any one of claims 1 to 15, characterized in that, in step (g) of the method as claimed in claim 1, said signals are quantified using a device capable of exciting the label and of measuring the signal emitted subsequent to the excitation.

17. The method as claimed in any one of claims 1 to 16, characterized in that, in step (h) of the method, a numerical ratio of the signals obtained with the plasmids containing the lesions to the signal obtained with the control plasmid located on the same support is established.

18. The use of the method as claimed in any one of claims 1 to 17, for establishing the repair profile of a given biological medium.

19. The use of the method as claimed in any one of claims 1 to 17, for diagnosing a repair-related disease.

20. The use of the method as claimed in any one of claims 1 to 17, for assessing the influence of a physical or chemical treatment on the repair capacities of a given medium.

21. The use of the method as claimed in any one of claims 1 to 17, for screening substances capable of modulating the repair system of a biological medium.